



Aquifer Analysis and Properties Formulas

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Examples!

Conversions!

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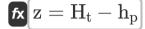


List of 27 Aquifer Analysis and Properties Formulas

Aquifer Analysis and Properties 🗗

Analysis of Aquifer-Test Data

1) Elevation Head using Total Head



Open Calculator

= 2.02 cm - 82 mm

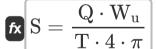
2) Pressure Head for given Total Head

fx $m h_p = H_t - z$

Open Calculator

 $82.2 \mathrm{mm} = 12.02 \mathrm{cm} - 38 \mathrm{mm}$

3) Storage Coefficient from Theis Equation of Transmissivity

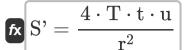


Open Calculator

$$oxed{ex} 0.10128 = rac{7 \mathrm{m}^3/\mathrm{s} \cdot 2}{11 \mathrm{m}^2/\mathrm{s} \cdot 4 \cdot \pi}$$



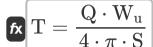
4) Theis Equation to determine Storage Coefficient



Open Calculator 2

 $extbf{ex} 16.05333 = rac{4 \cdot 11 ext{m}^2/ ext{s} \cdot 4 ext{s} \cdot 0.81}{\left(2.98 ext{m}
ight)^2}$

5) Theis equation to determine transmissivity



Open Calculator 2

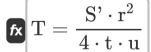
ex 11.03054m²/s = $\frac{7$ m³/s · 2 $4 \cdot \pi \cdot 0.101$

6) Total Head

fx $m H_t = z + h_p$ 12cm = 38mm + 82mm Open Calculator

Open Calculator

7) Transmissivity given Storage Coefficient from Theis Equation 🗗



 $extbf{ex} 10.99772 ext{m}^2/ ext{s} = rac{16.05 \cdot (2.98 ext{m})^2}{4 \cdot 4 ext{s} \cdot 0.81}$

Aquifer Properties







Compressibility of Aquifers

8) Barometric Efficiency given Compressibility Parameters 🗗

Open Calculator

$$BE = \left(\frac{\eta \cdot \beta}{\alpha} + \eta \cdot \beta\right)$$

$$2.32 = \left(\frac{0.32 \cdot 4.35}{1.5} + 0.32 \cdot 4.35 \right)$$

9) Coefficient of Storage for Unconfined Aquifer

 $\left|\mathbf{S}^{"}\right|\mathbf{S}^{"}=\mathbf{S}_{y}+\left(rac{\gamma}{1000}
ight)\cdot\left(lpha+\eta\cdoteta
ight)\cdot\mathbf{B}_{s}$

Open Calculator

$$85.28553 = 0.2 + \left(rac{9.807 ext{kN/m}^3}{1000}
ight) \cdot (1.5 + 0.32 \cdot 4.35) \cdot 3$$

10) Discharge per Unit Width of Aquifer 🗹

$$\mathbf{f} \mathbf{x} = (\mathbf{h}_{\mathrm{o}} - \mathbf{h}_{\mathrm{1}}) \cdot \mathbf{K}' \cdot rac{\mathbf{b}}{\mathbf{L}}$$

Open Calculator

ex
$$0.134615 \mathrm{m}^3/\mathrm{s} = (12 \mathrm{m} - 5 \mathrm{m}) \cdot 0.5 \mathrm{cm/s} \cdot \frac{15.0 \mathrm{m}}{3.9 \mathrm{m}}$$





11) Saturated Thickness of Aquifer when Coefficient of Storage for Unconfined Aquifer is Considered

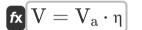
 $\mathbf{E}_{\mathrm{S}} = rac{\mathrm{S''} - \mathrm{S_y}}{\left(rac{\gamma}{1000}
ight) \cdot \left(lpha + \eta \cdot eta
ight)}$

Open Calculator 🗗

$$oxed{ex} 2.989933 = rac{85 - 0.2}{\left(rac{9.807 \mathrm{kN/m^3}}{1000}
ight) \cdot (1.5 + 0.32 \cdot 4.35)}$$

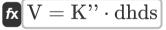
Darcy's Law

12) Apparent Velocity and Bulk Pore Velocity Relationship



Open Calculator

- $extbf{ex}$ $24 ext{m/s} = 75 ext{m/s} \cdot 0.32$
- 13) Apparent Velocity of Seepage



Open Calculator

 $oxed{ex} 24 ext{m/s} = 10 ext{m/s} \cdot 2.4$



14) Apparent Velocity of Seepage given Reynolds Number of Value Unity

$$V = rac{{
m Re} \cdot {
m v_{stokes}}}{{
m d_a}}$$

Open Calculator 🚰

 $ext{ex} \ 24.00662 ext{m/s} = rac{5000 \cdot 7.25 ext{St}}{0.151 ext{m}}$

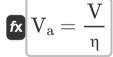
15) Apparent Velocity of Seepage when Discharge and Cross-Sectional Area are considered

 $V = rac{Q'}{A}$

Open Calculator

 $ext{ex} \ 24 ext{m/s} = rac{3.0 ext{m}^3/ ext{s}}{0.125 ext{m}^2}$

16) Bulk Pore Velocity



Open Calculator

 $\boxed{ 74.96875 \text{m/s} = \frac{23.99 \text{m/s}}{0.32} }$



17) Coefficient of Permeability when Apparent Velocity of Seepage is considered

fx $K" = rac{V}{dhds}$

Open Calculator

 $= \frac{9.995833 \text{m/s}}{2.4}$

18) Darcy's Law

fx $q_{
m flow} = K \cdot A_{
m cs} \cdot {
m dhds}$

Open Calculator

 $ext{ex} \ 24.024 ext{m}^3/ ext{s} = .77 ext{m/s} \cdot 13 ext{m}^2 \cdot 2.4$

19) Hydraulic Gradient when Apparent Velocity of Seepage is considered

 $dhds = \frac{V}{K''}$

Open Calculator

 $2.399 = \frac{23.99 \text{m/s}}{10 \text{m/s}}$

20) Kinematic Viscosity of Water given Reynolds Number of Value Unity

 $u_{
m stokes} = rac{{
m V}\cdot{
m d_a}}{{
m Re}}$

Open Calculator







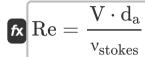
21) Representative Particle Size given Reynolds Number of Value Unity 🗹

fx $d_{
m a} = rac{{
m Re} \cdot {
m v}}{{
m V}}$

Open Calculator 🗗

$$oxed{ex} 0.20842 \mathrm{m} = rac{5000 \cdot 0.001 \mathrm{m}^2/\mathrm{s}}{23.99 \mathrm{m/s}}$$

22) Reynolds Number of Value Unity

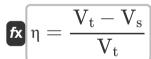


Open Calculator

$$= \frac{23.99 \text{m/s} \cdot 0.151 \text{m}}{7.25 \text{St}}$$

Porosity

23) Porosity



$$\boxed{ 0.321267 = \frac{22.1 \mathrm{m}^{_{3}} - 15 \mathrm{m}^{_{3}} }{22.1 \mathrm{m}^{_{3}} } }$$



24) Porosity given Bulk Pore Velocity

 $\eta = rac{
m V}{
m V_a}$

Open Calculator

25) Porosity given Specific Yield and Specific Retention

fx $\eta = S_y + S_r$

Open Calculator

 $\boxed{0.35 = 0.2 + 0.15}$

26) Total Volume of Soil or Rock Sample given Porosity

 $V_{
m t} = \left(rac{V_{
m v}}{\eta_{
m v}}
ight) \cdot 100$

Open Calculator 🖒

 $\boxed{22.4\mathrm{m}^{\scriptscriptstyle 3} = \left(\frac{5.6\mathrm{m}^{\scriptscriptstyle 3}}{25}\right) \cdot 100}$

27) Volume of Solids given Porosity

fx $V_{
m s} = (V_{
m t} \cdot (1-\eta))^{\gamma}$

Open Calculator

 $\texttt{ex} \ 15.028 \text{m}^{_3} = (22.1 \text{m}^{_3} \cdot (1-0.32))$



Variables Used

- A Cross Section Area of Porous Medium (Square Meter)
- A_{CS} Cross Sectional Area (Square Meter)
- **b** Aquifer Thickness (Meter)
- B_s Saturated Thickness of Aquifer
- BE Barometric Efficiency
- **d**_a Representative Particle Size (*Meter*)
- dhds Hydraulic Gradient
- h₁ Piezometric Head at Downstream End (Meter)
- **h** Piezometric Head at Upstream End (Meter)
- h_p Pressure Head (Millimeter)
- Ht Total Head (Centimeter)
- K Hydraulic Conductivity (Meter per Second)
- K' Permeability Coefficient (Centimeter per Second)
- K" Coefficient of Permeability (Meter per Second)
- **L** Length of Permeameter (*Meter*)
- q Discharge per Unit Width of Aquifer (Cubic Meter per Second)
- Q Pumping Rate (Cubic Meter per Second)
- Q' Discharge (Cubic Meter per Second)
- **Q**flow Flow Rate (Cubic Meter per Second)
- r Distance from Pumping Well (Meter)
- Re Reynolds Number
- S Storage Coefficient (Theis Equation)
- S' Storage Coefficient





- S" Coefficient of Storage for Unconfined Aquifer
- **S**_r Specific Retention
- S_v Specific Yield
- t Pumping Time (Second)
- T Transmissivity (Square Meter per Second)
- u Varying Dimensionless Group
- V Apparent Velocity of Seepage (Meter per Second)
- Va Bulk Pore Velocity (Meter per Second)
- V_S Volume of Solids (Cubic Meter)
- V_t Total Volume of Soil or Rock Sample (Cubic Meter)
- V_v Volume of Voids (Cubic Meter)
- W_{II} Well Function of U
- Z Elevation Head (Millimeter)
- α Compressibility
- B Compressibility of Water
- V Unit Weight of Fluid (Kilonewton per Cubic Meter)
- n Porosity of Soil
- η_v Volume Percent of Porosity
- V_{stokes} Kinematic Viscosity in Stokes (Stokes)
- U Kinematic Viscosity (Square Meter per Second)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Measurement: Length in Millimeter (mm), Centimeter (cm), Meter (m)
 Length Unit Conversion
- Measurement: Time in Second (s)

 Time Unit Conversion
- Measurement: Volume in Cubic Meter (m³)
 Volume Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Speed in Centimeter per Second (cm/s), Meter per Second (m/s)
 - Speed Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s)
 Volumetric Flow Rate Unit Conversion
- Measurement: Kinematic Viscosity in Square Meter per Second (m²/s), Stokes (St)
 Kinematic Viscosity Unit Conversion
- Measurement: Specific Weight in Kilonewton per Cubic Meter (kN/m³)
 Specific Weight Unit Conversion





Check other formula lists

- Aquifer Analysis and Properties Distance-Drawdown Analysis Formulas
- Coefficient of Permeability Formulas [7]
- Formulas
- Steady Flow into a Well Formulas C

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